

1 CLAIMS

2 What is claimed is:

- 3 1. A method for fabricating a fiber-optic waveguide, comprising the step of spatially  
4 selectively removing material from a cladding layer of an evanescent waveguide fiber  
5 segment of a waveguide optical fiber and forming an evanescent optical coupling portion of  
6 a cladding layer surface thereof, so that a remaining portion of the cladding layer is  
7 asymmetrically disposed about at least a portion of a core of the waveguide optical fiber,  
8 thereby enabling an evanescent portion of a propagating optical mode propagating  
9 therethrough to extend transversely beyond at least a portion of the coupling portion of the  
10 cladding layer surface of the evanescent waveguide fiber segment while being substantially  
11 transversely encompassed by respective cladding layers of two longitudinally adjacent fiber  
12 segments of the waveguide optical fiber.
- 13 2. A method for fabricating a fiber-optic waveguide as recited in Claim 1, wherein the  
14 cladding-material-removing step comprises spatially-selective etching of material from the  
15 cladding layer of the evanescent waveguide fiber segment of the waveguide optical fiber.
- 16 3. A method for fabricating a fiber-optic waveguide as recited in Claim 2, wherein the  
17 cladding-material-removing step comprises the steps of:  
18 providing the waveguide optical fiber with a mask that substantially covers the two  
19 longitudinally adjacent segments of the waveguide optical fiber but covers only portions  
20 of a length and a circumference of the evanescent waveguide fiber segment of the  
21 waveguide optical fiber; and  
22 spatially-selectively etching the waveguide optical fiber, thereby asymmetrically removing  
23 material from the cladding layer of the evanescent waveguide fiber segment of the  
24 waveguide optical fiber.
- 25 4. A method for fabricating a fiber-optic waveguide as recited in Claim 3, wherein the mask-  
26 providing step comprises spatially-selective removal of an outer fiber coating from portions  
27 of the length and circumference of the evanescent waveguide fiber segment and the mask  
28 comprises portions of the outer fiber coating remaining on the two longitudinally adjacent  
29 segments of the waveguide optical fiber and on the evanescent waveguide fiber segment.

- 1    5. A method for fabricating a fiber-optic waveguide as recited in Claim 4, wherein the mask-  
2       providing step comprises spatially-selective laser-machining of the outer fiber coating.
- 3    6. A method for fabricating a fiber-optic waveguide as recited in Claim 5, further comprising  
4       the step of partially rotating the waveguide optical fiber during laser machining, thereby  
5       removing mask material from arcuate portions of a surface of the waveguide optical fiber  
6       extending partially around a circumference thereof.
- 7    7. A method for fabricating a fiber-optic waveguide as recited in Claim 5, wherein the  
8       waveguide optical fiber rotates within a capillary tube during laser machining, thereby  
9       providing substantially concentric rotation during laser machining.
- 10   8. A method for fabricating a fiber-optic waveguide as recited in Claim 5, further comprising  
11       the steps of: rotating the waveguide optical fiber during laser machining, and modulating a  
12       laser used for laser machining synchronously with rotation of the waveguide optical fiber,  
13       thereby removing mask material from arcuate portions of a surface of the waveguide optical  
14       fiber extending partially around a circumference thereof.
- 15   9. A method for fabricating a fiber-optic waveguide as recited in Claim 5, wherein the outer  
16       fiber coating comprises a polymeric jacket and laser machining is performed with a UV-  
17       emitting excimer laser.
- 18   10. A method for fabricating a fiber-optic waveguide as recited in Claim 5, wherein the outer  
19       fiber coating comprises a carbon coating and laser machining is performed with a pulsed  
20       laser.
- 21   11. A method for fabricating a fiber-optic waveguide as recited in Claim 5, wherein the outer  
22       fiber coating comprises a carbon coating and laser machining is performed with a  
23       substantially continuous laser.
- 24   12. A method for fabricating a fiber-optic waveguide as recited in Claim 5, wherein the outer  
25       fiber coating comprises a photo-resist material.
- 26   13. A method for fabricating a fiber-optic waveguide as recited in Claim 3, wherein the mask-  
27       providing step comprises spatially-selective deposition of an outer fiber coating on the two  
28       longitudinally adjacent segments of the waveguide optical fiber and on portions of the length  
29       and circumference of the evanescent waveguide fiber segment, and the mask comprises the  
30       outer fiber coating thus deposited.

- 1 14. A method for fabricating a fiber-optic waveguide as recited in Claim 13, wherein the mask-  
2 providing step comprises spatially-selective metal vapor deposition of the outer fiber  
3 coating.
- 4 15. A method for fabricating a fiber-optic waveguide as recited in Claim 14, wherein shadow  
5 masking techniques are employed to implement the spatially-selective metal vapor  
6 deposition of the outer fiber coating.
- 7 16. A method for fabricating a fiber-optic waveguide as recited in Claim 3, wherein the  
8 spatially-selective etching step is performed using aqueous hydrofluoric acid.
- 9 17. A method for fabricating a fiber-optic waveguide as recited in Claim 16, wherein the  
10 aqueous hydrofluoric acid comprises between about 5% HF and about 50% HF buffered  
11 with  $\text{NH}_4\text{F}$ .
- 12 18. A method for fabricating a fiber-optic waveguide as recited in Claim 17, wherein the  
13 aqueous hydrofluoric acid comprises between about 7% HF and about 8% HF buffered with  
14 between about 30%  $\text{NH}_4\text{F}$  and about 40%  $\text{NH}_4\text{F}$ .
- 15 19. A method for fabricating a fiber-optic waveguide as recited in Claim 3, wherein the  
16 waveguide optical fiber is polarization-maintaining optical fiber, comprising longitudinally  
17 extending stressor elements disposed within the cladding layer in substantially opposing  
18 positions about the core, the stressor elements being etched at a slower rate than the cladding  
19 layer, thereby yielding transversely protruding passive alignment structures as a result of the  
20 cladding-material-removing step.
- 21 20. A method for fabricating a fiber-optic waveguide as recited in Claim 19, wherein the passive  
22 alignment structures are adapted to engage longitudinally adjacent fiber segments of a fiber-  
23 ring whispering-gallery-mode optical resonator, thereby enabling reproducible substantially  
24 tangential engagement of the evanescent waveguide fiber segment and a fiber-ring  
25 whispering-gallery-mode optical resonator and enabling reproducible evanescent optical  
26 coupling between a whispering-gallery optical mode of the fiber-ring resonator and the  
27 propagating optical mode of the evanescent waveguide fiber segment.
- 28 21. A method for fabricating a fiber-optic waveguide as recited in Claim 3, wherein the  
29 cladding-material-removing step further comprises the step of removing the mask from the  
30 waveguide optical fiber.

1 22. A method for fabricating a fiber-optic waveguide as recited in any of Claims 1 through 21,  
2 wherein the cladding-material-removing step further comprises the step of controlling a  
3 shape and size of the coupling portion of the cladding layer surface of the evanescent  
4 waveguide fiber segment.

5 23. A method for fabricating a fiber-optic waveguide as recited in Claim 22, wherein:  
6 the cladding-material-removing step comprises the steps of  
7 providing the waveguide optical fiber with a mask that substantially covers the two  
8 longitudinally adjacent segments of the waveguide optical fiber but covers only  
9 portions of a length and a circumference of the evanescent waveguide fiber  
10 segment of the waveguide optical fiber, and  
11 spatially-selectively etching the waveguide optical fiber, thereby asymmetrically  
12 removing material from the cladding layer of the evanescent waveguide fiber  
13 segment of the waveguide optical fiber; and  
14 the optical-coupling-portion-shape-and-size-controlling step comprises controlling a shape  
15 and a size of an area of the evanescent waveguide fiber segment left uncovered by the  
16 mask-providing step.

17 24. A method for fabricating a fiber-optic waveguide as recited in Claim 23, wherein a width  
18 and a circumferential extent of the area of the evanescent waveguide fiber segment left  
19 uncovered by the mask-providing step are controlled, thereby controlling the shape and size  
20 of the coupling portion of the cladding layer surface of the evanescent waveguide fiber  
21 segment.

22 25. A method for fabricating a fiber-optic waveguide as recited in Claim 23, wherein:  
23 the area left uncovered by the mask-providing step comprises a plurality of arcuate segments  
24 of the cladding layer surface, the arcuate segments extending partially around the  
25 circumference of the waveguide optical fiber and being separated from adjacent arcuate  
26 segments by intervening portions of the mask; and  
27 number, widths, circumferential extents, and spacings from adjacent arcuate segments are  
28 controlled for the plurality of arcuate segments, thereby controlling the shape and size  
29 of the coupling portion of the cladding layer surface of the evanescent waveguide fiber  
30 segment.

- 1 26. A method for fabricating a fiber-optic waveguide as recited in Claim 22, wherein the  
2 coupling portion of the cladding layer surface of the evanescent waveguide fiber segment  
3 has a saddle-like shape, having a concave longitudinal-sectional shape near at least a portion  
4 of the core of the evanescent waveguide fiber segment and a convex transverse-sectional  
5 shape near at least a portion of the core of the evanescent waveguide fiber segment.
- 6 27. A method for fabricating a fiber-optic waveguide as recited in Claim 26, wherein the  
7 concave longitudinal-sectional shape of the coupling portion of the cladding layer surface is  
8 adapted to receive and substantially tangentially engage a whispering-gallery-mode optical  
9 resonator, and to enable evanescent optical coupling between a whispering-gallery optical  
10 mode of the resonator and the propagating optical mode in the evanescent waveguide fiber  
11 segment.
- 12 28. A method for fabricating a fiber-optic waveguide as recited in Claim 26, wherein the convex  
13 transverse-sectional shape of the coupling portion of the cladding layer surface is adapted to  
14 enable substantial tangential engagement of the coupling portion of the cladding layer  
15 surface and a fiber-ring whispering-gallery-mode optical resonator, and to enable evanescent  
16 optical coupling between a whispering-gallery optical mode of the fiber-ring resonator and  
17 the propagating optical mode in the evanescent waveguide fiber segment.
- 18 29. A method for fabricating a fiber-optic waveguide as recited in Claim 22, wherein the  
19 coupling portion of the cladding layer surface of the evanescent waveguide fiber segment  
20 has a pit-like shape, having a concave longitudinal-sectional shape near at least a portion of  
21 the core of the evanescent waveguide fiber segment and a concave transverse-sectional  
22 shape near at least a portion of the core of the evanescent waveguide fiber segment.
- 23 30. A method for fabricating a fiber-optic waveguide as recited in Claim 29, wherein the  
24 concave longitudinal-sectional shape of the coupling portion of the cladding layer surface is  
25 adapted to receive and substantially tangentially engage a whispering-gallery-mode optical  
26 resonator, and to enable evanescent optical coupling between a whispering-gallery optical  
27 mode of the resonator and the propagating optical mode in the evanescent waveguide fiber  
28 segment.
- 29 31. A method for fabricating a fiber-optic waveguide as recited in Claim 29, wherein the  
30 concave transverse-sectional shape of the coupling portion of the cladding layer surface is

1 adapted to enable substantial tangential engagement of the coupling portion of the cladding  
2 layer surface and a micro-disk whispering-gallery-mode optical resonator, and to enable  
3 evanescent optical coupling between a whispering-gallery optical mode of the micro-disk  
4 resonator and the propagating optical mode in the evanescent waveguide fiber segment.

5 32. A method for fabricating a fiber-optic waveguide as recited in Claim 22, wherein the  
6 coupling portion of the cladding layer surface of the evanescent waveguide fiber segment  
7 has a concave longitudinal-sectional shape near at least a portion of the core of the  
8 evanescent waveguide fiber segment and a substantially flat transverse-sectional shape near  
9 at least a portion of the core of the evanescent waveguide fiber segment, the concave  
10 longitudinal-sectional shape of the coupling portion of the cladding layer surface being  
11 adapted to receive and substantially tangentially engage a whispering-gallery-mode optical  
12 resonator, and to enable evanescent optical coupling between a whispering-gallery optical  
13 mode of the resonator and the propagating optical mode in the evanescent waveguide fiber  
14 segment.

15 33. A method for fabricating a fiber-optic waveguide as recited in Claim 1, wherein the  
16 cladding-material-removing step further comprises the step of controlling the amount of  
17 cladding material removed from the evanescent wave fiber segment.

18 34. A method for fabricating a fiber-optic waveguide as recited in Claim 33, wherein the  
19 controlling step comprises the steps of:  
20 monitoring optical loss of the waveguide optical fiber during the cladding-material-  
21 removing step; and  
22 terminating the cladding-material-removing step in response to the optical loss of the  
23 waveguide optical fiber reaching a pre-determined level.

24 35. A method for fabricating a fiber-optic waveguide as recited in Claim 34, wherein the pre-  
25 determined optical loss level is between about 0.1 dB and about 30 dB.

26 36. A method for fabricating a fiber-optic waveguide as recited in Claim 34, wherein the pre-  
27 determined optical loss level is between about 0.1 dB and about 10 dB.

28 37. A method for fabricating a fiber-optic waveguide as recited in Claim 34, wherein the pre-  
29 determined optical loss level is between about 0.1 dB and about 3 dB.

- 1 38. A method for fabricating a fiber-optic waveguide as recited in Claim 34, wherein the pre-  
2 determined optical loss level is between about 0.1 dB and about 1 dB.
- 3 39. A method for fabricating a fiber-optic waveguide as recited in Claim 33, wherein a  
4 minimum distance between the core of the waveguide optical fiber and the coupling portion  
5 of the cladding layer surface is between about 0  $\mu\text{m}$  and about 10  $\mu\text{m}$  as a result of the  
6 cladding-material-removing step.
- 7 40. A method for fabricating a fiber-optic waveguide as recited in Claim 33, wherein the core of  
8 the waveguide optical fiber is partially exposed as a result of the cladding-material-  
9 removing step.
- 10 41. A fiber-optic waveguide fabricated by the method of any of Claims 1 through 40.
- 11 42. A fiber-optic waveguide, comprising:  
12 an evanescent waveguide fiber segment comprising a core and a cladding layer;  
13 a first longitudinally adjacent fiber segment comprising a core and a cladding layer, the  
14 cladding layer substantially surrounding the core and substantially transversely  
15 encompassing a propagating optical mode propagating through the first adjacent fiber  
16 segment; and  
17 a second longitudinally adjacent fiber segment comprising a core and a cladding layer, the  
18 cladding layer substantially surrounding the core and substantially transversely  
19 encompassing a propagating optical mode propagating through the second adjacent  
20 fiber segment,  
21 wherein:  
22 the first adjacent fiber segment is joined at an end thereof to a first end of the evanescent  
23 waveguide fiber segment and the second adjacent fiber segment is joined at an end  
24 thereof to a second end of the evanescent waveguide fiber segment;  
25 the core of the first adjacent fiber segment, the core of the evanescent waveguide fiber  
26 segment, and the core of the second adjacent fiber segment form a substantially  
27 continuous core of the fiber-optic waveguide, thereby enabling a propagating optical  
28 mode to propagate therethrough; and  
29 the cladding layer of the evanescent waveguide fiber segment is asymmetrically disposed  
30 about at least a portion of the core thereof, thereby yielding a coupling portion of a  
31 cladding layer surface of the evanescent waveguide fiber segment and enabling an

1           evanescent portion of the propagating optical mode to extend transversely beyond at  
2           least a portion of the coupling portion of the cladding layer surface of the evanescent  
3           waveguide fiber segment.

4   43. A fiber-optic waveguide as recited in Claim 42, wherein the coupling portion of the cladding  
5   layer surface of the evanescent waveguide fiber segment has a saddle-like shape, having a  
6   concave longitudinal-sectional shape near at least a portion of the core of the evanescent  
7   waveguide fiber segment and a convex transverse-sectional shape near at least a portion of  
8   the core of the evanescent waveguide fiber segment.

9   44. A fiber-optic waveguide as recited in Claim 43, wherein the concave longitudinal-sectional  
10  shape of the coupling portion of the cladding layer surface is adapted to receive and  
11  substantially tangentially engage a whispering-gallery-mode optical resonator, and to enable  
12  evanescent optical coupling between a whispering-gallery optical mode of the resonator and  
13  the propagating optical mode in the evanescent waveguide fiber segment.

14  45. A fiber-optic waveguide as recited in Claim 43, wherein the convex transverse-sectional  
15  shape of the coupling portion of the cladding layer surface is adapted to enable substantial  
16  tangential engagement of the coupling portion of the cladding layer surface and a fiber-ring  
17  whispering-gallery-mode optical resonator, and to enable evanescent optical coupling  
18  between a whispering-gallery optical mode of the fiber-ring resonator and the propagating  
19  optical mode in the evanescent waveguide fiber segment.

20  46. A fiber-optic waveguide as recited in Claim 42, wherein the coupling portion of the cladding  
21  layer surface of the evanescent waveguide fiber segment has a pit-like shape, having a  
22  concave longitudinal-sectional shape near at least a portion of the core of the evanescent  
23  waveguide fiber segment and a concave transverse-sectional shape near at least a portion of  
24  the core of the evanescent waveguide fiber segment.

25  47. A fiber-optic waveguide as recited in Claim 46, wherein the concave longitudinal-sectional  
26  shape of the coupling portion of the cladding layer surface is adapted to receive and  
27  substantially tangentially engage a whispering-gallery-mode optical resonator, and to enable  
28  evanescent optical coupling between a whispering-gallery optical mode of the resonator and  
29  the propagating optical mode in the evanescent waveguide fiber segment.



- 1 48. A fiber-optic waveguide as recited in Claim 46, wherein the concave transverse-sectional  
2 shape of the coupling portion of the cladding layer surface is adapted to enable substantial  
3 tangential engagement of the coupling portion of the cladding layer surface and a micro-disk  
4 whispering-gallery-mode optical resonator, and to enable evanescent optical coupling  
5 between a whispering-gallery optical mode of the micro-disk resonator and the propagating  
6 optical mode in the evanescent waveguide fiber segment.
- 7 49. A fiber-optic waveguide as recited in Claim 42, wherein the coupling portion of the cladding  
8 layer surface of the evanescent waveguide fiber segment has a concave longitudinal-  
9 sectional shape near at least a portion of the core of the evanescent waveguide fiber segment  
10 and a substantially flat transverse-sectional shape near at least a portion of the core of the  
11 evanescent waveguide fiber segment, the concave longitudinal-sectional shape of the  
12 coupling portion of the cladding layer surface being adapted to receive and substantially  
13 tangentially engage a whispering-gallery-mode optical resonator, and to enable evanescent  
14 optical coupling between a whispering-gallery optical mode of the resonator and the  
15 propagating optical mode in the evanescent waveguide fiber segment.
- 16 50. A fiber-optic waveguide as recited in Claim 42, wherein a thickness of the cladding layer  
17 between the coupling portion of the cladding layer surface and the core of the evanescent  
18 waveguide fiber segment yields a pre-determined level of optical loss of the evanescent  
19 waveguide fiber segment.
- 20 51. A fiber-optic waveguide as recited in Claim 50, wherein the pre-determined optical loss  
21 level is between about 0.1 dB and about 30 dB.
- 22 52. A fiber-optic waveguide as recited in Claim 50, wherein the pre-determined optical loss  
23 level is between about 0.1 dB and about 10 dB.
- 24 53. A fiber-optic waveguide as recited in Claim 50, wherein the pre-determined optical loss  
25 level is between about 0.1 dB and about 3 dB.
- 26 54. A fiber-optic waveguide as recited in Claim 50, wherein the pre-determined optical loss  
27 level is between about 0.1 dB and about 1 dB.
- 28 55. A fiber-optic waveguide as recited in Claim 42, wherein a minimum distance between the  
29 core of the evanescent waveguide fiber segment and the coupling portion of the cladding  
30 layer surface is between about 0  $\mu\text{m}$  and about 10  $\mu\text{m}$ .

- 1 56. A fiber-optic waveguide as recited in Claim 55, wherein the core of the evanescent  
2 waveguide fiber segment is partially exposed.
- 3 57. A fiber-optic waveguide as recited in Claim 42, wherein the adjacent fiber segments and  
4 evanescent waveguide fiber segment are fabricated from polarization-maintaining optical  
5 fiber, and each of said segments further comprises longitudinally extending stressor  
6 elements disposed within the respective cladding layer in substantially opposing positions  
7 about the respective core, the stressor elements of the evanescent waveguide segment  
8 serving as transversely protruding passive alignment structures.
- 9 58. A fiber-optic waveguide as recited in Claim 57, wherein the passive alignment structures are  
10 adapted to engage longitudinally adjacent fiber segments of a fiber-ring whispering-gallery-  
11 mode optical resonator, thereby enabling reproducible substantially tangential engagement  
12 of the evanescent waveguide fiber segment and a fiber-ring whispering-gallery-mode optical  
13 resonator and enabling reproducible evanescent optical coupling between a whispering-  
14 gallery optical mode of the fiber-ring resonator and the propagating optical mode of the  
15 evanescent waveguide fiber segment.
- 16 59. A method for fabricating a resonant optical power control device incorporating a fiber-optic  
17 waveguide fabricated by the method of any of Claims 1 through 40 or recited in any of  
18 Claims 41 through 58, comprising the steps of:  
19 positioning and securing the fiber-optic waveguide within a waveguide-alignment groove of  
20 an alignment device; and  
21 positioning and securing a whispering-gallery-mode optical resonator within a resonator-  
22 alignment groove of the alignment device,  
23 wherein:  
24 the whispering-gallery-mode optical resonator is provided with an alignment member for  
25 accurately positioning the resonator in the resonator-alignment groove;  
26 the alignment device comprises a first alignment substrate, and the waveguide-alignment  
27 groove and the resonator-alignment groove are provided on a first surface of the first  
28 alignment substrate; and  
29 the waveguide-alignment groove and the resonator-alignment groove of the alignment  
30 device position the whispering-gallery-mode optical resonator in substantial tangential  
31 engagement with the coupling portion of the cladding layer surface of the evanescent

1 waveguide fiber segment of the fiber-optic waveguide, thereby evanescently optically  
2 coupling the resonator fiber segment and the fiber-optic waveguide.

3 60. A method for fabricating a resonant optical power control device as recited in Claim 59,  
4 wherein the whispering-gallery-mode optical resonator comprises a fiber-ring of an optical  
5 fiber, the fiber ring having a spatial differential of a physical property of the optical fiber  
6 between a resonator segment of the optical fiber and longitudinally adjacent segments of the  
7 optical fiber, thereby enabling substantial confinement by the resonator fiber segment of a  
8 substantially resonant whispering-gallery optical mode propagating around the  
9 circumference of the fiber at least partially within the resonator fiber segment, and at least  
10 one of the adjacent fiber segments serves as the resonator alignment member.

11 61. A method for fabricating a resonant optical power control device as recited in Claim 59,  
12 wherein the whispering-gallery-mode optical resonator comprises a micro-sphere connected  
13 to a tapered portion of a resonator optical fiber, the resonator optical fiber substantially  
14 coinciding with a symmetry axis of the micro-sphere and serving as the resonator alignment  
15 member.

16 62. A method for fabricating a resonant optical power control device as recited in Claim 59,  
17 wherein the resonator-alignment groove and the waveguide-alignment groove are  
18 substantially perpendicular, and differ in depth so that the coupling portion of the cladding  
19 layer surface of the evanescent waveguide fiber segment of fiber-optic waveguide is in  
20 contact with the circumference of the whispering-gallery-mode optical resonator when the  
21 fiber-optic waveguide and resonator alignment member are positioned within the  
22 waveguide-alignment groove and the resonator-alignment groove, respectively.

23 63. A method for fabricating a resonant optical power control device as recited in Claim 59,  
24 further comprising the step of sealing the alignment device, thereby isolating the fiber-optic  
25 waveguide and the whispering-gallery-mode resonator from a use environment.

26 64. A method for fabricating a resonant optical power control device as recited in Claim 59,  
27 wherein the resonator alignment member is provided with an alignment structure and the  
28 resonator-alignment groove is provided with a corresponding alignment structure, thereby  
29 enabling reproducible optical coupling of the whispering-gallery-mode optical resonator and  
30 the coupling portion of the cladding layer surface of the evanescent waveguide fiber  
31 segment of fiber-optic waveguide when the resonator alignment member and the  
32 corresponding alignment structure of the resonator-alignment groove are engaged.

- 1 65. A method for fabricating a resonant optical power control device as recited in Claim 64,  
2 wherein the resonator alignment member comprises a substantially annular circumferential  
3 flange, and the corresponding alignment structure of the resonator-alignment groove  
4 comprises a transverse groove for receiving the flange.
- 5 66. A method for fabricating a resonant optical power control device as recited in Claim 64,  
6 wherein the corresponding alignment structure of the resonator-alignment groove comprises  
7 an inwardly-protruding transverse flange, and the resonator alignment member comprises a  
8 substantially circumferential groove for receiving the flange.
- 9 67. A method for fabricating a resonant optical power control device as recited in Claim 59,  
10 further comprising the steps of positioning and securing a second optical waveguide within a  
11 second waveguide alignment groove of the alignment device, wherein the second  
12 waveguide-alignment groove and the resonator-alignment groove of the alignment device  
13 position the resonator fiber segment in substantial tangential engagement with the second  
14 optical waveguide, thereby evanescently optically coupling the whispering-gallery-mode  
15 resonator and the second optical waveguide and enabling routing of optical power of the  
16 propagating optical mode from the fiber-optic waveguide into the second optical waveguide.
- 17 68. A method of fabricating a resonant optical power control device as recited in Claim 67,  
18 wherein the second optical waveguide comprises a second fiber-optic waveguide fabricated  
19 by the method of any of Claims 1 through 40 or recited in any of Claims 41 through 58.
- 20 69. A method for fabricating a resonant optical power control device as recited in Claim 59,  
21 wherein the whispering-gallery-mode resonator is provided with a modulator for controlling  
22 optical properties of the whispering-gallery-mode resonator, and the alignment device is  
23 provided with a modulator control element.
- 24 70. A method for fabricating a resonant optical power control device as recited in Claim 69,  
25 wherein the modulator control element enables application of an electronic signal to the  
26 modulator for controlled modulation of the optical properties of the whispering-gallery-  
27 mode resonator.
- 28 71. A method for fabricating a resonant optical power control device as recited in Claim 69,  
29 wherein the modulator control element enables application of an optical signal to the  
30 modulator for controlled modulation of the optical properties of the whispering-gallery-  
31 mode resonator.

- 1 72. A method for fabricating a resonant optical power control device as recited in Claim 69,  
2 further comprising the step of sealing the alignment device, thereby isolating the fiber-optic  
3 waveguide, resonator fiber segment, and modulator from a use environment.
- 4 73. A method for fabricating a resonant optical power control device as recited in Claim 69,  
5 further comprising the step of positioning a secondary optical assembly on the alignment  
6 device in substantial tangential engagement with the whispering-gallery-mode resonator,  
7 thereby optically coupling the resonator and the secondary optical assembly and enabling  
8 controlled modulation of optical coupling of the whispering-gallery-mode resonator and the  
9 secondary optical assembly through the controlled modulation of the optical properties of  
10 the whispering-gallery-mode resonator.
- 11 74. A method for fabricating a resonant optical power control device as recited in Claim 73,  
12 wherein the secondary optical assembly comprises second fiber-optic waveguide.
- 13 75. A method for fabricating a resonant optical power control device as recited in Claim 73,  
14 wherein the secondary optical assembly comprises a second whispering-gallery-mode  
15 optical resonator.
- 16 76. A method for fabricating a resonant optical power control device as recited in Claim 73,  
17 further comprising the step of sealing the alignment device, thereby isolating the fiber-optic  
18 waveguide, resonator fiber segment, modulator, and secondary optical assembly from a use  
19 environment.
- 20 77. A method for fabricating a resonant optical power control device as recited in Claim 59,  
21 further comprising the steps of positioning and securing a modulator optical assembly on the  
22 alignment device in substantial tangential engagement with the whispering-gallery-mode  
23 resonator, thereby evanescently optically coupling the resonator and the modulator optical  
24 assembly and enabling controlled modulation of optical coupling of the resonator and the  
25 modulator optical assembly through the controlled modulation of the optical properties of  
26 the modulator optical assembly.
- 27 78. A method for fabricating a resonant optical power control device as recited in Claim 77,  
28 wherein the alignment device comprises a second alignment substrate having the modulator  
29 optical assembly secured thereto and adapted to enable reproducible optical coupling of the  
30 whispering-gallery-mode resonator and the modulator optical assembly.
- 31 79. A method for fabricating a resonant optical power control device as recited in Claim 78,  
32 further comprising sealing the second alignment substrate onto the first alignment substrate,

thereby isolating the fiber-optic waveguide, whispering-gallery-mode resonator, and modulator optical assembly from a use environment.

80. A method for fabricating a resonant optical power control device as recited in Claim 77, wherein the alignment device is provided with a modulator control element for controlled modulation of the optical properties of the modulator optical assembly.

81. A method for fabricating a resonant optical power control device as recited in Claim 80, wherein the modulator control element enables application of an electronic signal to the modulator optical assembly for controlled modulation of the optical properties of the modulator optical assembly.

82. A method for fabricating a resonant optical power control device as recited in Claim 80, wherein the modulator control element enables application of an optical signal to the modulator optical assembly for controlled modulation of the optical properties of the modulator optical assembly.

83. A method for fabricating a resonant optical power control device as recited in Claim 77, wherein the modulator optical assembly comprises an optical loss modulator.

84. A method for fabricating a resonant optical power control device as recited in Claim 77, wherein the modulator optical assembly comprises a non-linear optical device.

85. A method for fabricating a resonant optical power control device as recited in Claim 77, wherein the modulator optical assembly comprises an electro-optic device.

86. A method for fabricating a resonant optical power control device as recited in Claim 77, wherein the modulator optical assembly comprises an electro-absorptive device.

87. A method for fabricating a resonant optical power control device as recited in Claim 77, wherein the modulator optical assembly comprises a semiconductor device.

88. A method for fabricating a resonant optical power control device as recited in Claim 77, wherein the modulator optical assembly comprises a second whispering-gallery-mode optical resonator.

89. A method for fabricating a resonant optical power control device as recited in Claim 77, wherein the modulator optical assembly comprises a second fiber-optic waveguide.

90. A resonant optical power control device fabricated according to the method of any of Claims 59 through 89.

91. A resonant optical power control device, comprising:

1 an alignment device comprising a first alignment substrate having a waveguide-alignment  
2 groove and a resonator-alignment groove on a first surface thereof;  
3 a fiber-optic waveguide, fabricated by the method of any of Claims I through IB3 or recited  
4 in any of Claims II through IIIF1, secured within the waveguide-alignment groove;  
5 a whispering-gallery-mode optical resonator secured within the resonator-alignment groove,  
6 wherein the waveguide-alignment groove and the resonator-alignment groove of the  
7 alignment device position the resonator fiber segment in substantial tangential  
8 engagement with the coupling portion of the cladding layer surface of the evanescent  
9 waveguide fiber segment of the fiber-optic waveguide, thereby evanescently optically  
10 coupling the resonator fiber segment and the fiber-optic waveguide.

11 92. A resonant optical power control device as recited in Claim 91, further incorporating the  
12 limitations of any of Claims 59 through 89.  
13